

**THESIS**

**ESTIMATION OF IRRIGATION EFFICIENCY BY USING  
GEOGRAPHICAL INFORMATION SYSTEM & REMOTE SENSING**



**Muhammad Abrar Faiz  
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## ABSTRACT

Pakistan has a rich and vast natural resource base covering various climatic zones that strengthen the agriculture in Pakistan. The relatively good yield in agricultural products is related to timely availability of the required quantity of water besides other inputs. In the context of agriculture, water and yield, the subject of consumptive use of water is becoming increasingly important, particularly in arid and semi-arid areas of Pakistan. This research study aims to determine the effectiveness and utility of remote sensing in determining the water consumption by the crops like wheat, cotton, sugarcane and fodder in Khanewal and Lodhran which are the two districts of Multan Division having plain area where the agriculture is mainly dependent upon Canal water and tubewell water. The main objective of this research is to assess the actual evapotranspiration of *Rabi* cropped area by satellite image, applying Surface Energy Balance Algorithm for Land (SEBAL) and comparison with the estimated values obtained CROPWAT model. Satellite Remote Sensing allows instantaneous analyses of the situation as well as temporal to give an immediate response towards assessment and monitoring of evapotranspiration in a short time period as compared to field techniques.

The calculated values of ET for the cultivated area through SEBAL of *Rabi* crops (wheat) and vegetation in the study area are 5 mm/day and 6 mm/day respectively. Similarly, the average calculated value of evapotranspiration through CROPWAT model for cultivated area and vegetation are 6 mm/day and 7 mm/day, respectively. The resultant pattern of evapotranspiration shows the range of 6 mm/day within the vicinity of the meteorological observatory of Multan, hence the average normalized value of ET calculated through SEBAL is in the close approximation of average value calculated through CROPWAT model. The value for the vegetation evapotranspiration shows variation with the cultivated region. One of the strong

reasons for this variation is the maturity level of crop growth. Calculated values of crop water requirement for cultivated region are 144 mm for the month of November for wheat. The results show that the remote sensing technique is used to estimate evapotranspiration and coupled with CROPWAT model shows great potential to calculate the water consumption spatially with the help of SEBAL in the study area.